American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

# Factors Influencing District Health Information Software Version 2 Success – A Case of the Greater Bushenyi Districts, Uganda

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**Abstract**

Evaluating success factors of District Health information software version2 (DHIS2) is an essential in the field of information systems in a developing country context. DHIS2is vital for Uganda health care system particularly for monitoring sustainable development goals and thus facilitating public health decision making, health sector reviews, planning, resource allocation. From the literature reviewed the desire to determine the variables that measure the success factors for information Systems continues. Despite, the studies, in the developing countries context like Uganda, there are few and with inadequate criteria to evaluate the DHIS2 success factors. This study aims at identifying success factors in relation to the theoretical framework of DeLeon and MacLean model 2003. Considerations for Resource supply, Education and training and Management support are key for the success of the District Health information Software Version2 in the five districts of the greater Bushenyi Districts- Uganda in developing country perspective.

***Keywords:*** DHIS2; Information Systems Success; Health Information systems; DeLeone & McLean; Greater Bushenyi Districts; Uganda.

## 1. Introduction

Health Information systems (HIS) have emerged as an essential public health tool.

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Today, information systems (IS) provide real time data to guide health care system particularly for public health decision making, health outcomes assessment, program and clinic administration, health sector reviews, planning, resource allocation, monitoring and evaluation of health programs and services.

Monitoring of the Sustainable development goals in particular the 3rd "ensure Healthy lives and promote wellbeing for all at all ages" this goal directly relates to health and can be monitored by functional health information systems [24]. This is an indicator to be monitored by the United Nations for the period 2030; the strides nations will have taken can only be out a good health information system.

Uganda invested highly in the implementation of an electronic health information system (District Health information Software version2) with the major focus on integrating health data to improve health services delivery. All the health facilities in Uganda use the system to capture vital data on health indicators [18].

District Health Information Software Version 2 (DHIS2) is " an integrated web based, country owned and managed, national health information system that integrates quality data used at all levels to improve health service delivery" [11,13].

DHIS2 for Uganda was resultant of numerous reviews of the National Health Information Systems [18, 23]. These reviews identified a number of issues as described by Kiberu[18] that included poor data quality in terms of reliability, availability, timeliness, completeness of reporting that compromised health service delivery.

The challenges above catalysed the adoption of DHIS2 by Uganda in August 2010 when it contacted the University of Oslo to customise the Uganda version. DHIS2 is a web based frame work and is a Free and Open source Software. DHIS2 runs in most operation systems both on line and off line modes. Because of its open architecture, it easily integrates with other Personal computer applications [18].

By December 2015 a total of 47 countries had adopted DHIS2 of which 20 countries are in Africa including Uganda, Kenya, Tanzania, Rwanda, Burundi, South Africa, South Sudan, DRC, Malawi, Ghana, Mozambique, Senegal, Niger, Nigeria, Togo, Zimbabwe, Zambia, Algeria, Guinea Bissau, Namibia [10].

DHIS2 is used by the District health information officers, Health information Assistant, District Biostasticians, and District health management team members. All users have been trained on effective use of the system. The system has been so far described to be solving the challenges of data quality. Improved data quality in terms of completeness and timelines of data on health services has been registered from the districts to the Ministry of Health [18].

Health information systems are a set of interrelated components working together to gather, retrieve, process, store and disseminate information to support the activities of the health system planning and decision making both in management and service delivery [23].Sinha [37] recognized Health Information systems to include Decision Support Systems (DSS) National Health Management Information Systems, Hospital Information Systems, Integrated Disease Surveillance Systems, Patient Data Management systems, and Clinical Information Systems.

The World Health Organisation (WHO) has it as a goal and priority thus encourages and supports nations to invest in Health information systems and statistics to improve Country, Regional and global Health information management. This information is vital for public health decision making, health sector reviews, planning and resource allocation, programme monitoring and evaluation [32].

The use of Health information Systems in Uganda are more beneficial as they ease record keeping, enhance communication, perform simple calculations, support decision making, facilitates gaining competitive advantage, better management of chronic diseases, faster retrieval of record, improving process flow and productivity [27].

## 2. DHIS 2 factors assessment

Assessment of DHIS 2 trails Information systems success studies already carried out in this field that has attracted considerable interest by practitioners and researchers with the desire to understand the value and efficiency of IS management actions and IS Investments [9, 29]. Organisations continue to invest in information technology (IT) and the budgets on IT products like IS are rising despite the economic hardships [29]. This has exerted pressure and competition leading to cutting down costs of doing business. The businesses have to examine and measure the benefits and costs on IT and the expected return on investment.

Evaluating/assessing information systems is paramount if the investments in IT resources that are used to build IS is advantageous to the business like promoting competitive advantage to the firm thus measuring success helps the firm to understand how the IS improves performance and value attained by the firm [5]. Information systems are a huge investment to organisations and therefore huge expectations of positive impact from them [12]. However information systems are under scrutiny to justify their value to organisations that implement them.

There is a general appreciation that a number of applications and systems have been deployed of these some are ***hedonic,*** developed for pleasure and enjoyment. Others are ***Utilitarian*** developed to improve individual and organisational performance [29]. This study is assessing a national health informational system DHIS2 as a utilitarian system.

Therefore evaluating/assessing information systems success has been in the past decades attracted different schools of thought that have developed a series of models and theories to evaluate and explicate what makes an information system effective/successful. Inspirational and often cited theories including DeLone and MacLean 1992 (D&M), Technology acceptance model (TAM), Saundars and Jones 1992, Myers and his colleagues, 1997, and the update D&M 2003.

### *2.1 Information systems Success*

A number researches have analysed the IS success factors, the most identified factors include; information system quality, information quality, system use, net benefits [7]. Perceived usefulness, decision maker's satisfaction and management decision making [27].

Information system success factor glanced as top management support, change recognition, planning project as change, managerial activity, effective communication, organisation readiness to deal with change, employees training, employee involvement, employee satisfaction, information flow and performance measurement [27,34,33]. System usability, training, perceptions/attitude, cost, project champion, internet connection speed, and reliability of the internet connection for the cloud based systems [14].

Ziemba[34] pointed out the accelerating factors for information systems success as the economic, social and organisational factors. For example the national wealth, human capital, ICT infrastructure, rule of law, organisational change and leadership support.

However these factors are crosscutting to the most of the studies in the information systems success arena. Most organisations evaluate information systems success based on two areas i.e. the performance in terms of technical efficiency and the other being user satisfaction from the use of the system to execute business transactions [29].

### *2.2 Health Information Systems Failure*

Information system failures are usually driven by the perceptions of people involved in them, the negative attitudes and lack of motivation [38]. Heeks[17] recognised two major issues of IS failure as below.

- Total failure where a system is implemented and immediately gets abandoned
- Partial failure where the outcomes of the system are partially meeting the system requirements and thus not meeting the system goals.

HIS failure is rampant that a number of systems have failed to meet their intended goals and objectives. We acknowledge that system failure is a big loss to an organisation in particular developing countries like Uganda. We appreciate that the MoH Uganda a resource constrained country invested a lot of tax payers money to implement the DHIS2 to the extent that donors sunk a lot of funds to this system thus its failure would be detrimental [25]. The major causes of failure of IS is the transfer of information systems from one environment to another environment. The health facilities at each level differ in terms of management and resource allocation and similarly the systems outsourced from developed countries and deployed in the developing countries situations differ and calls for observations.

Heeks[16] in the study of HIS success and failure in the developing countries realised that 15% of HIS succeed while 85% are partially implemented or completely fail. The major causes identified were; user resistance to change even when the system technically well packaged to deliver to the expectations, negative attitude, and resource constraints.

Low usage of system due to attitude of different users of the HIS in a Somalia coupled with inadequate training and lack of skilled expertise caused low attitude to use, lack of IT support and shared computer access with frequent power interruptions leading to user dissatisfaction [30].

The causes of DHIS2 already identified in Kenya are inadequate training to users, low deployment to all

facilities yet it's a national system, lack of management support. Even those that have deployed were not fully utilising the system to generate important information for use at the facilities [19].

Amanyire[1] identified the causes of HIS failure in developing countries as skills deficiency for the computer usage, resistance to change, inadequacy of necessary Information technology infrastructure, high cost of information systems infrastructure. These are consequently being realised as the major factors for information systems failure in resource constrained countries

Resource constraints, resistance to change, inadequate information of system structure, and high cost of information systems, and inadequate IT equipment were the factors for HIS in Small and Medium Enterprises in Uganda [27]. These are the same enterprises that the study is evaluating a system that was deployed five years ago in a semi -rural setup to determine its success factors for DHIS2 in Bushenyi District.

### *2.3 Information systems Successes theories*

#### *2.3.1 A re-specified model of the DeLone and McLean model be Seddon 1997*

Seddon [36] in his article "A re-specification of the Delone and Mclean model of IS success" the theory critiqued the information system use dimension as vague. It is argued that IS use has three meanings and thus ambiguous.

1. Information system **use**: used as the benefits from use have the similar meaning to the individual impact. This makes the system use dimension absolute.
2. Information system **use** as the dependent variable predicts future use and it is thus a behavioural description
3. Information system **use** used as the consequence of use. Here the use is used as the user satisfaction, individual impact, organisational impact rather than the success measurement

Seddon argues that the three meanings of use dimension are ambiguous and misleading and opted for the removal of the use dimension from the Delone and Maclean model. He came up with a re-specified model in 1997

#### *2.3.2 Gable and his colleagues 's Model 2008*

The model expounds IS impact as "a point in time, of the stream net benefits form the IS, to date anticipate, as perceived by all user groups." The IS-impact model consists of four constructs of information quality (IQ), System quality (SQ), individual impact (II) and organisational impact (OI) and shown in figure 3. The model benchmarks DeLone and MacLean work of 1992 though differing in the following ways: (a) it portrays a measurement model and does not support a causal model of success, (b) it removes the construct use, (c) Satisfaction is considered an overall measure of success instead of a construct of success, (d) new measures were included to the contemporary IS context and organisational characteristics, (e) it includes additional measure to probe a more holistic organisational impact construct [12].

### *2.3.3 Technology Acceptance Model (TAM) by Davis (1989)*

The model was built on a theory that user's intention to adopt a new technology is determined by two key beliefs that is, perceived usefulness and perceived ease of use. Perceived usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance [6] and perceived ease of use is the degree to which a person believes that using a particular system would be free of effort This theory was derived from Theory of Reason Action (TRA) which urges that individual behavioral intention is determined by two factors that is attitude, which is the degree an individual has positive or negative feelings about performing the target behavior and subjective norm which captures the persons perception that most people who are important to him think H/She should not perform the behavior in question .Attitude is formed based on an individual's beliefs about consequences of particular behavior and subjective norm is formed based on an individual's perceptions of social normative pressures. The two main factors in TAM can actually be regarded as beliefs resulting in attitude [6].

### *2.3.4 Myers and his colleagues's model of Information systems assessment 1997*

Myers [26] based on Saundars and Jones model to develop the "contingency theory of information systems assessment". The model extends Saundars and Jones model (1992) in assessing quality and productivity of Information system function. Myers and his colleagues model appreciates the contingency factors and the dimensions of information systems success. The Myers and his colleagues model considers the six dimensions of information systems success of DeLone and MacLean model (1992). It brings two new dimensions i.e. service quality and workgroup impact [26].

### *2.3.5 The Update D&M Success Model 2003*

DeLone and MCLean in 2003 revised their model introducing three major dimensions: Information Quality, Systems Quality, and Service Quality. Each should be measured – or controlled for -- separately, because singularly or jointly, they will affect subsequent Use and User Satisfaction [8].

Interpreting the multidimensional aspects of Use – mandatory versus voluntary, informed versus uninformed, effective versus ineffective, etc. – they suggested that Intention to Use may be a worthwhile alternative measure. Intention to Use is an attitude, while Use is behaviour [8]

As was true in the original formulation of the D&M Model, Use and User Satisfaction are closely interrelated. Use must precede User Satisfaction in a process sense, but positive experience with USE will lead to greater User Satisfaction in a causal sense.

Similarly, increased User Satisfaction will lead to increased Intention to Use and thus Use. As a result of this Use and User Satisfaction, certain Net Benefits will occur. If the information system or service is to be continued, it is assumed that the Net Benefits from the perspective of the owner or sponsor of the system are positive, thus influencing and reinforcing subsequent Use and User Satisfaction [9].

## 3. Critique of the theories

The theories present a good view for the analysis of IS success. The strength and weaknesses in the existing models are here presented including: - their basis to determine success on factors that are technical issues of functionality, organizational issues, human factors, willingness to change and net benefits. It was a general observation that all the models measured technical functionalities of the systems.

The D&M model has been the most cited by other writers in the empirical studies and validated it as the valid success measures of information systems [20, 22, 35, 2, 1, 31]. This study therefore undertakes development of a conceptual a model based on the D&M model of 2003 to incorporate the DHIS2 success factors in the greater Bushenyi Districts Uganda.

Health facilities in greater Bushenyi Districts differ in size; There are regional Hospitals, District Hospital, Hospitals, Health centre IV's, Health centre III's and Health centre II's, all expected to implement DHIS2 at their level. All these facilities differ in terms resource allocation, man power, managerial environment. Most of these facilities are in remote are where source of power is inadequate, understaffed, and health facility staff trained in medical practice majority with no ICT skills.

Uganda is a developing country and thus the level of ICT operationalization is quite different from the developed countries environment.

For instance the technology processes objectives, motivations, skills and staffing, management and structures and financial resources. Thus the theories developed in developed countries cannot function wholesomely with regard to DHIS2 implementation; it would be an underestimation [16].

The major causes of IS Failure in developing countries are skills scarcity, resistance to computer technology, poor planning, lack of management support, poorly designed systems, high cost of information systems and limited resources. These are not typically addressed in the above models and are the consequential to failure of IS in developing countries, thus a justification to determine a combination of factors that can address these challenges.

## 4. Methodology

This study will use document review of the published journal articles. Critical literature review on information systems failure and success, evaluations in the health care and Information systems success models – IS evaluation studies.

## 5. DHIS2 success factors in the greater Bushenyi Districts

Based on the Literature and the theories have examined, a benchmark of the Seddon and his colleagues's 1997 theory, Davis Theory 1989, Myres and his colleagues's 1997, Gable and his colleagues's 2008 and updated DeLone and McLean 2003. The success factors of DHIS2 in the greater Bushenyi Districts, Uganda were

identified as the table below illustrates.

.**Table 1:** Comparison of the Success measurement theories

| **Factors** | **Seddon 1997** | **TAM model** | **Myers and his colleagues; 1997** | **Gable and his colleagues, 2008** | **D&M 2003** | **Conceptual** |
|---|---|---|---|---|---|---|
| Attitude | X | □ | X | X | X | □ |
| Behavioral Intention | X | □ | X | X | X | □ |
| Education and training | X | X | X | X | X | □ |
| Feed back | □ | X | X | X | X | □ |
| Individual impact | X | X | □ | X | □ | □ |
| Information quality | □ | X | □ | □ | □ | □ |
| Management support | X | X | X | X | X | □ |
| Net benefits | □ | X | □ | □ | □ | □ |
| Organizational impact | □ | X | □ | □ | □ | □ |
| Perceived Ease of Use | X | □ | X | X | X | □ |
| Perceived usefulness | X | □ | X | X | X | □ |
| Resource Supply | X | X | X | X | X | □ |
| Service Quality | □ | X | □ | X | □ | □ |
| System Quality | □ | X | □ | □ | □ | □ |
| System use | □ | □ | □ | □ | □ | □ |
| User satisfaction | □ | X | □ | □ | □ | □ |
| Workgroup impact | X | X | □ | X | X | □ |

**Key**

| | |
|---|---|
| □ | Included in the theory |
| X | Not included |

Table 1, above identified IS success factors including attitude, behavioral intention, individual impact, information quality, net benefits, organizational impact, and perceived ease of use, perceived usefulness service quality, system quality, user satisfaction and work group impact.

The factors identified tailored for the DHIS2 in a developing country environment; Resource supply, Education and training as well as Management support as pivotal to system intention to use and general use for the net benefits to be realized.

## 6. Recommendations

This work should be continued to analysis and test the hypothesizes thus the exercise of data collection form 86 health facilities out of 110 in the greater Bushenyi Districts. The data is to be analyzed, using regression analysis for validity.

## 7. Conclusions

This paper identified the salient success factors for the DHIS2 for the greater Bushenyi Districts Uganda in the developing country context as the: - Resource supply that involves supply of computers and modems, electricity/source of power and internet. Education and training involving training users on computer and system use, continued mentorship and training. Management support inform of continued monitoring and evaluation, technical support during the implementation phase.

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